



University of Michigan Occupational Safety & Environmental Health Campus Safety Services Building 1239 Kipke Drive, Ann Arbor, MI 48109-1010 Phone: 734 647-1143 • Fax: 734 763-1185

Terrance G. Alexander, Director

August 22, 2005

Harry R. Steinmetz (3HS62) US Environmental Protection Agency, Region 3 1650 Arch Street Philadelphia, PA 19103-2029

Re: Safety Light Corporation Site, Bloomsburg, Pennsylvania

Response to Inquiry of July 21, 2005 (received by UM July 26, 2005)

Dear Mr. Steinmetz:

The University of Michigan (UM) is responding to your request for information on the above referenced Safety Light Corporation Site (Site). Attached is a memorandum that provides a detailed inventory of radiation sources the University purchased from US Radium/Safety Light over the years, and a discussion of their final disposition. The following are specific responses to the questions asked in your information request.

1. Describe in detail the business relationship between Michigan and Safety Light.

The UM routinely purchases radiation sources from vendors for use in research activity. US Radium/Safety Light was a vendor that supplied small sources of strontium-90 (six sources from 1955-58), polonium-210 (two sources from 1965-66), americium-241 (thirty-seven sources from 1965-68), tritium (no record on number of sources from 1965-68), radium-226 (five sources in 1965), Isolite Pm-147 (one source, unknown year), and titanium tritide tritium targets (unknown number in 1980-90s). In addition the University purchased several Safety Light/Isolite self-luminous exit signs for use on campus. Detailed information on each of these sources is provided in the attached memorandum and copies of our file documentation.

2. Did Michigan ever transport and/or broker hazardous substances and/or radioactive waste or other wastes that were disposed of or reclaimed by U.S Radium, Lime Ridge Industries, USR Industries, USR Metals, Metreal, Isolite to the Site?

No, the University of Michigan is not a transporter or broker of waste materials for disposal.

- 3. If you answered "yes" to Question 2, please answer the following questions: answered "no" to question 2.
- 4. Did Michigan ever generate radioactive waste or other waste that were disposed of or reclaimed by U.S Radium, Lime Ridge Industries, USR Industries, USR Metals, Metreal, Isolite at the Site?

Safety Light Corporation Site, Bloomsburg, Pennsylvania Response to Inquiry of July 21, 2005 August 22, 2005 Page 2

No. After an extensive search of our records, the University of Michigan found no documentation that we used any of the above listed firms for disposal of radioactive or other waste materials. The attached documentation goes into detail on the disposition of the source materials purchased from the above listed firms. During the time frame in question our disposal vendors for radioactive waste materials included: Nuclear Engineering Co. (currently US Ecology) with disposal at Morehead, Kentucky; Atomic Disposal Co. (currently ADCO, Inc.); US Ecology; and GTS Duratek.

Our records do indicate that four americium-241 sources out of 37 purchased were returned to US Radium (two in 1966 and two in 1967, each within one year of purchase). The leak test records attached to this letter indicate that after the laboratory processed the sources received from US Radium, the four that were returned measured material leakage on three and the fourth was received from US Radium with no leak test documentation. It is our speculation the sources were returned by the researcher because they were out of specification for the research project being performed, and as with any items that do not meet purchase specifications, they are returned to the vendor. We have no indication as to what US Radium did with the returned sources.

- 5. If you answered "yes" to Question 4, please address the following issues: answered "no" to question 4.
- 6. If you have reason to believe there may be persons able to provide more detailed or complete responses to any question contained herein, or who may be able to provide additional responsive documents, provide the names, titles, areas of responsibility, current addresses, and telephone numbers of such persons as well as additional information or documents they may have.

The University of Michigan has no reason to believe there are other records or persons available with more information on this inquiry.

7. For each and every question contained herein, if information or documents responsive to this Information Request are not in your possession, custody, or control, then provide the names, titles, areas of responsibility, current addresses, and telephone numbers of the persons from whom such information or documents may be obtained.

Documents responsive to the questions in this information request are within our control.

8. If you have any other information about other party(ies) who may have information that may assist the Agency in its investigation of the Site, or who may be responsible for the generation of, transportation to, or release of contamination at the Site, please provide such information.

The University of Michigan has no additional information we are aware of pertaining to the Site.

9. If any of the documents solicited in this information request are no longer available, please indicate the reason why they are no longer available.

Safety Light Corporation Site, Bloomsburg, Pennsylvania Response to Inquiry of July 21, 2005 August 22, 2005 Page 3

To the best of our knowledge, we have provided the documents solicited in this information request where required by the question. We have no knowledge of other documents pertinent to this information request.

Based on the information in our files, it appears the University has returned only four (4) low activity Americium-241 sources to the Site for unknown future action by US Radium. Based on the information provided in this letter and the attachments, it appears the University of Michigan in a worst case scenario would have been connected with less than 110 gallons or less than 200 pounds of material that may have been handled by Safety Light, and all of which would have been handled prior to April 1, 2001. We request that EPA consider the University of Michigan under the de micromis exemption of 42 USC 9607(o)(1). Your response will be greatly appreciated. If you have any questions please give me a call at (734) 647-2253 or e-mail tgalex@umich.edu.

Sincerely,

Terrance G. Alexander, PE, CIH

Director

Attachments: Records Review Memorandum

Information on Sources Identified in EPA Letter

Sources Used in Goddard Space Flight Center (GSFC) Project

Miscellaneous Sources

Copy to:

H. Baier

T. Blessing

S:/ood/environmental issues/EPA Inquiry – Safety Light Site

RECORDS REVIEW MEMORANDUM



University of Michigan Occupational Safety & Environmental Health Campus Safety Services Building 1239 Kipke Drive, Ann Arbor, MI 48109-1010 Phone: 734 647-1143 • Fax: 734 763-1185

1) Hahir

Terrance G. Alexander, Director

TO:

Terrance Alexander, Director

Occupational Safety and Environmental Health

FROM:

Dennis A. Palmieri, Sr. OSEH Rep

Occupational Safety and Environmental Health

DATE:

August 15, 2005

SUBJECT:

EPA CERCLA Inquiry Letter of 21 July 2005

Per your request, I have searched departmental records for sealed sources to identify and assess the disposition of the radioactive sources manufactured by US Radium Corp / Safety Light and identified specifically by the EPA in its letter to the University of 21 July 2005. As part of that search, I noted that we retained records indicating the University acquired other sources from the same manufacturer. I have included a summary of these "miscellaneous" sources along with what is known about them.

In brief summary, I was able to locate the records for all except one of the sources noted by the EPA in its letter. The one source record I could not locate was for a Po210 source listed in the Safety Light ledger as having an activity of 0.625 mCi on 6/11/65. It should be noted that Po210 has a half-life of about 138 days and decays to a stable isotope. Records for all the other specified sources note that all were either disposed through an appropriate radioactive waste broker for burial in a licensed landfill or were transferred to other institutions.

However, other source records identifying sources acquired from US Radium Corp. indicate that four of 37 Am241 sources acquired by the University from US Radium Corp. were returned to the manufacturer in 1966 and 1967. There was no indication as to why the sources were returned. Two of the sources were accompanied by a notation indicating they were "scrapped". However, it is possible that the sources were not returned "for disposal" but were returned because they failed to meet research specifications. It doesn't appear to have been the practice to dispose of the other sources through return to the manufacturer. Most of the sources were transferred to the Goddard Space Flight Center. Other remaining sources apparently were collected by Radiation Control Service (predecessor to OSEH Radiation Safety Service) for disposal. Those sources were held in storage until May of 2003 when disposed by OSEH HM & RS through GTS Duratek.

In conclusion, as a customer of the US Radium Corp / Safety Light Co., the University of Michigan acquired radioactive sources as end-products for use in research and for safety lighting. While the University did return four discrete sources to the manufacturer in 1966-67 for unknown reasons, it does not otherwise appear that the UM made a practice of returning radioactive sources to US Radium / Safety Light for disposal.

Identification and Disposition of Sources Listed in Safety Light Material Ledger Sheet

1.0 Sources Identified in Material Ledger

The CERCLA inquiry letter ("EPA Letter") provided a copy of a ledger of radioactive sources supplied to the University of Michigan from US Radium Corp. in the early 1950s. Only two radionuclides were listed. Sr90, is an energetic beta emitter with a half-life of 28.8 years, and Po210, is an alpha emitter with a half-life of only 138.4 days.

The ledger listed six Sr90 sources and two Po210 sources:

Nuclide	Serial No.	Initial Activity (mCi)	Ledger Date
S r90	377	20	3/1/1955
S r90	378	20 (8)	3/1/1955
S r90	985	18 ^(b)	9/26/1955 ^(c)
S r90	986	18 ^(b)	9/26/1955 ^(e)
S r90	987	18 ⁽⁸⁾	9/26/1955 ^(c)
Sr90	13464	18	1/7/1958
Po210	55693	0.312	2/28/1966
Po210	none	0.625	6/11/1965

- a) The Ledger identifies the activity for this source as "60 mCi". This is likely an error. Contemporaneous UM records for that particular Sr90 source (s/n #378) consistently identify the nominal activity as 20 mCi. The lower activity designated in UM records corresponds with that for the other similar sources which were all obtained and used for the same purpose.
- b) The Ledger aggregates the total activity for the 3 sources (s/n 985, 986 and 987) as 54 mCi. That corresponds to 18 mCi per source which better corresponds to UM contemporaneous records of 20 mCi nominal per source.
- c) The Ledger Date for sources s/n 986,987 and 988 does not specify the year the sources were supplied to the UM. Based upon the AEC approval period, and the pattern shown with the other sources in the Ledger, it is likely that the supply date is 9/26/55.

2.0 <u>Historical Summary per University Records by Identified Source</u>:

According to the Safety Light / US Radium Ledger, a number of the sources identified were issued to UM under letter authorizations issued by the US Atomic Energy Commission (AEC). These letter "licenses" were commonly used by the AEC prior to its drafting and implementing licensing regulations as required by the Atomic Energy Act of 1954. The University of Michigan obtained a license (21-00215-04) in accordance with the new regulations sometime in 1957 or 1958. Prior to that date, institutions or individual researchers could apply to the US AEC for letter authorizations approving receipt of particular sources from specific suppliers. During these early years, the University of Michigan appointed a Radiation Policy Committee to conform and centralize radiological safety, security and approvals. A service was formed in the later 1950s titled "Radiation Control Service" (RCS) to identify users of radioactive materials at the University and assist in the oversight of those uses. For that reason, the dates

on some of the records maintained by RCS for the sources listed in the EPA letter commence a few years after the source may have been supplied pursuant to the Ledger Date in the Safety Light Ledger. Radiation Control Service was the predecessor to what is now OSEH-Radiation Safety Service (RSS).

2.1 Sr-90 Source #377

US Radium Corp. / Safety Light records indicate that the UM order for this source was filled on 3/1/55. The company issued the source to UM under approval of AEC letter authorization number 31353 dated February 15, 1955. UM records for this source commence on 3/28/57. The source was used as a microphotometer light source by a Prof. Blackwell of the Vision Research Lab which was located in Rm. 21A of Mason Hall. It was briefly transferred to Willow Run Research Labs in September of 1958 (probably upon the departure of Prof. Blackwell to The Ohio State University sometime earlier). It was then collected for storage in the UM Radiation Control Service safe where it remained until disposal in 1969.

Disposal records indicate that the source was packaged as radioactive waste (along with Sr90 Source #986) in solid waste "barrel #12" sometime between May of 1969 and July of 1969. Barrel #12 along with its contents including Sr90 (with a total decay-corrected activity of 29.4 mCi accounting for both Sources #377 and #986) was listed on a Radioactive Waste Manifest #4719 dated July 9, 1969. Manifest #4719 listed radioactive materials intended for shipment to Nuclear Engineering Co (currently US Ecology) in Morehead, KY for burial at the radioactive waste site located there. A corresponding memo to file by Mr. N.L. Millis, Radiation Control Service Health Physicist indicates that the shipment to Nuclear Engineering Co. occurred on 14 July 1969 and was received at the site on July 21, 1969.

Copies of the Leak Test record, Manifest #4719 and the 14 July 1969 memo are attached.

2.2 Sr-90 Source #378

US Radium Corp. / Safety light records indicate that the UM order for this source was filled on 3/1/55. The company issued the source to UM under approval of AEC letter authorization number 31353 dated February 15, 1955. UM records for this source commence on 3/28/57. Line 5 of the Ledger states the source activity as 60 mCi. This appears to be in error. UM records identify the nominal activity as approximately 20 mCi. Similar sources were all apparently acquired for the same purpose in 1955 and 1956 and were all approximately 20 mCi. For that reason, it is likely that the Ledger notation is in error.

Source #378 was used as a microphotometer light source by a Prof. Blackwell of the Vision Research Lab which was located in Rm. 21A of Mason Hall. The source was transferred in September of 1958 to the UM Radiation Control Service storage safe where it remained until disposed in 1978 (probably upon the departure of Prof. Blackwell to The Ohio State University). Leak test records dated 21 March 1978 indicate the source was transferred to "Barrel #67" for disposal by Atomic Disposal Co. (currently ADCO, Inc) via burial.

Disposal packaging records for 21 March 1978 list the contents of Barrel #67 and specifically identify Source #378 by serial number (along with Source #13464). The packaging records note that the barrel was sent out 28 March 1978 as part of the 3d waste shipment for that year. Radioactive Waste Manifest No. 10926, dated 28 March 1978, confirms that the material was listed as part of that shipment.

Copies of the Leak Test record, Manifest #10926 and the UM Disposal Packaging Record for 3/21/78 are attached.

2.3 **Sr**-90 Source #985

US Radium Corp. / Safety Light records indicate that the UM order for this source was filled on what appears to be either 26 September 1955 or 1956. The notations are unclear. The company issued the source to UM under approval of AEC letter authorization number 35383 dated 26 August 1955.

UM records for this source commence on 3/28/57. The source was used as a microphotometer light source by a Prof. Blackwell of the Vision Research Lab which was located in Rm. 21A of Mason Hall. The leak test record indicates that the source was transferred to The Ohio State University sometime after 15 September 1958 in the care of Prof. Blackwell. It is likely that Prof. Blackwell left the UM to engage in academic and research pursuits at OSU and the source was transferred as part of that relocation. There are no other records indicating a return of the source to the UM.

A copy of the Leak Test Record is attached.

2.4 Sr-90 Source #986

US Radium Corp. / Safety Light records indicate that the UM order for this source was filled on what appears to be either 26 September 1955 or 1956. The notations are unclear. The company issued the source to UM under approval of AEC letter authorization number 35383 dated 26 August 1955.

UM records for this source commence on 3/28/57. The source was used as a microphotometer light source by a Prof. Blackwell of the Vision Research Lab which was located in Rm. 21A of Mason Hall. It was transferred to UM Radiation Control Service sometime between April and November of 1958 probably upon the departure of Prof. Blackwell to The Ohio State University. It was then transferred to the Willow Run Labs around May of 1959 where it remained until 1961. The source was returned to Radiation Control Service in 1961 due to some apparent degradation of the housing. It remained in storage until its disposal in 1969.

Disposal records indicate that the source was packaged as radioactive waste (along with Sr90 Source #377) in solid waste "barrel #12" sometime between May of 1969 and July of 1969. Barrel #12 along with its contents including Sr90 (with a total decay-corrected activity of 29.4 mCi accounting for both Sources #377 and #986) was listed on a Radioactive Waste Manifest #4719 dated July 9, 1969. Manifest #4719 listed radioactive materials intended for shipment to Nuclear Engineering Co (currently US Ecology) in Morehead, KY for burial at the radioactive waste site located there. A corresponding memo to file by Mr. N.L. Millis, Radiation Control Service Health Physicist indicates that the shipment to Nuclear Engineering Co. occurred on 14 July 1969 and was received at the site on July 21, 1969.

Copies of the Leak Test record, Manifest #4719 and the 14 July 1969 memo are attached.

US Radium Corp. / Safety Light records indicate that the UM order for this source was filled on what appears to be either 26 September 1955 or 1956. The notations are unclear. The company issued the source to UM under approval of AEC letter authorization number 35383 dated 26 August 1955.

UM records for this source commence on 3/28/57. The source was used as a microphotometer light source by a Prof. Blackwell of the Vision Research Lab which was located in Rm. 21A of Mason Hall. The leak test record indicates that the source was transferred to The Ohio State University sometime after 15 September 1958 in the care of Prof. Blackwell. It is likely that Prof. Blackwell left the UM to engage in academic and research pursuits at OSU and the source was transferred as part of that relocation. There are no other records indicating a return of the source to the UM.

A copy of the Leak Test record is attached

2.6 Sr-90 Source #13464

This source was issued to the UM under its AEC Byproduct Materials License No. 21-00215-04. The date noted next to the Ledger entry is not likely to correspond to the shipment date because it is later than several of the entries in the UM Leak Test records corresponding to that source. The UM Leak Test record estimates a receipt date as sometime in 1956. The leak test records commenced on 10 November 1957.

The source was acquired by the Willow Run Laboratories with indication that it had been used as a light source originally by a Dr. Gordon of the "Radar Lab" at that facility. The source remained in use at Willow Run until 1969 when it was collected for storage in the RCS safe. Leak test records dated 21 March 1978 indicate the source was transferred to "Barrel #67" for disposal by Atomic Disposal Co. (currently ADCO, Inc) via burial.

Disposal packaging records for 21 March 1978 list the contents of Barrel #67 and specifically identify Source #378 by serial number (along with Source #378). The packaging records note that the barrel was sent out 28 March 1978 as part of the 3d waste shipment for that year. Radioactive Waste Manifest No. 10926, dated 28 March 1978, confirms that the material was listed as part of that shipment.

Copies of the Leak Test record, Manifest #10926 and the UM Disposal Packaging Record for 3/21/78 are attached

2.7 Po-210 Source #55693 of 1966; 0.312 mCi

Leak test records for this source identify it as having been received at University of Michigan on 2/28/66 although the record does not identify the source specifically by serial number. The source was used by a Prof. Bach at the Fluids Laboratory (now G.G. Brown Bldg) which housed the Civil Engineering Dept.

The source was retained for use in that laboratory until, at least, 23 June 1970. The leak test records indicate that the source had decayed to a level that no longer required monitoring. No other records could be found regarding disposal of the source. It appears that the source was retained until it had decayed to a level indistinguishable from that of background radiation. Po-

210 has a half-life of only 138.4 days. The remaining source activity as of 23 June 1970 would have been 0.00012 mCi.

A copy of the Leak Test record is attached.

2.8 **Po-210 Source of 6/11/65**, 0.625 mCi (no serial number)

No leak test records could be found identifying this source. However, it is likely that it was held for use or in storage in the same manner as Po-210 source #55693 until nearly all residual radioactivity had decayed. Po210 has a half-life of only 138.4 days and decays to a non-radioactive daughter product.

Identification of Other Sources Acquired from USRC / Safety Light Not Noted by EPA

A search of UM records indicate that the University obtained other sources from US Radium Corporation / Safety Light. Almost all of these appear to have been disposed using radioactive waste brokers. However, records for four discrete Am-241 sources indicate those sources were returned to US Radium Corp.

3.0 Americium 241 Sources for Space Physics Research Labs (SPRL)

A memo, dated 3/13/68, sent to the PML Health Physicist at the time, Mr. N. Millis, included an inventory of 37 discrete Am241 sources that were acquired from the US Radium Corp from 1965 through 1968. These sources were part of a research program conducted by a Prof. Horvath of the Space Research Labs. The sources were also under the charge of a Mr. Handy, an engineering research associate apparently involved in the research project. The research project was tied to the Goddard Space Flight Center (GSFC) in some manner as many of the 37 sources listed were transferred to the GSFC according to the inventory and as indicated by some GSFC transfer logs included with the inventory sheets.

The inventory specifically notes that four of the 37 Am241 sources, identified as Source Nos. 5P, 6P, 11P and 12P, were returned to US Radium Corp. Source 5P was returned on 5/25/66. Source 6P was returned on 10/26/66, the other two sources were returned sometime in November of 1967 with the notation "scrapped".

The other remaining sources were transferred to the GSFC, disposed as radioactive waste through the University's Radiation Control Service (now OSEH/ Radiation Safety Service) or retained in storage. Additional sources were later acquired in 1970 from a separate, unrelated vendor. There is an inventory record of two sources acquired on 12/21/70 from "NRD" which likely refers to NRD, Inc—a separate, unaffiliated producer of radioactive sources that is still in business.

It appears that any remaining Am-241 sources were disposed by OSEH / HM & RS in May of 2003 through GTS Duratek in a shipment of an estimated 40 mCi (without decay correction) of Am241 sources. These were collected from the SPRL many years back by RCS—likely sometime in the late 1980s. They were held in storage for many years at the old N. University Bldg facility and, later, at the Beck Road Storage Facility until adequate disposal options became available again.

3.1 Tritium Sources for Space Physics Research Labs (SPRL):

The 3/13/68 memo also references tritium sources noting that they are no longer at UM. GSFC transfer records dated June 14, 1966 show that these sources were all transferred to the GSFC. The transfer records note that these were all produced by US Radium Corp.

4.0 Radium Static Eliminator

Other sources identified included a static eliminator device containing a series of five Ra-226 sources as used by a Prof. Tourtelotte in Kresge II Bldg. Records indicate that these were manufactured by the US Radium Corp. All the sources were eventually transferred to the Veterans Administration Hospital in Los Angeles in 1971. A letter from the VA Hospital acknowledging the transfer is attached.

5.0 Pm-147 "Isolite" Source

A single record identifies a Pm-147 source used by a Prof. Hays. There is no indication of the origin of the source however it is described as an "Isolite" which is a product name used by Safety Light Corp. The source record indicates it was disposed in Barrel #147 on 10/11/73 and shipped to Nuclear Engineering Co. at Morehead, KY for disposal by burial.

6.0 <u>Titanium Tritide Targets</u>

Also, a number of sources were received by Prof. Glenn Knoll of Nuclear Engineering for use in a neutron generator during the 1980 and 1990s. The sources were up to 5 Ci of titanium tritide (H3) each and manufactured by Safety Light. A copy of a Safety Light MSDS was included by Prof. Knoll in one of his authorization applications identifying it as the vendor.

These **so**urces typically were collected by RCS / RSS for storage at PML until disposal for burial through a waste broker (e.g. ADCO or US Ecology). The current Radiation Safety Officer was the N. Campus Health Physicist during much of the time when this research program was in effect. He indicates his practice was to entomb the sources in a steel drum filled with concrete. These were then shipped to a radioactive waste broker. In addition, RSS sealed source records show that Alan Jackson, former OSEH Health Physicist, disposed of a number of these sources through US Ecology in 1997. Others were transferred to the University of Texas that same year along with the neutron generator machine. There was never any practice of returning these sources to the manufacturer.

7.0 Self-luminous Exit Signs

Finally, from time-to-time, the University acquired Safety Light / Isolite self-luminous "exit" signs for use on campus. There are no particular records of these purchases because they were acquired under general license. Current construction guidelines discourage the acquisition of these signs.

OSEH maintains a sign retrieval program. Self-luminous signs are retrieved and sent for recycling. OSEH HM & RS records note that several Isolite signs were sent to SRB Technologies in Winston-Salem, NC for recycling. SRB is an independent manufacturer of self-luminous signs.

At this **tim**e, there are three additional Isolite signs in OSEH inventory. Two are at the NCTF and one is in the locked cabinet in Rm. 1503 of the CSSB. These will likely be sent to SRB for recycling.

INFORMATION ON SOURCES IDENTIFIED IN EPA LETTER

Mason Hall

Sr 90

20 mc 1956? Sr 90 sulphate (Blackwell)

Thick walked glass-metal backing Vision Research thick walled glass-metal bucking 6-16-65 20.005 pc. To detectable RCS safe Room 21A 3-28-57 No detectable activity 12-29-65 <0.005 pc - To detectable RCS safe 6-8-66 <0.005 pc - To detectable RCS safe 1-5.58 No detectable activity Room 21A 4-15-58 No detectable activity Willow Run 20.005 ac Q.C.S. Softe 3-20-59 No detectable activity R.C.S. safe 12-14-66 Residence 2 9. 005 6-2-67 9-4-59 No detectable activity R.C.S. safe RCS. Safe 20.005 pie 12-18-67 3.18-60 No detectable activity R.C.S. safe RCS Seef 9-22-60 No declectable activity | R.C.S. sofe 40.005 Jac. 6-12-68 RCS Sufe 6-20-61 % detectable activity R.C.S. safe 40.005 LEC 12-19-68 Vin posed of May - 1969 2-12-61 No Ketestall activity RCS safe 6-22-62 Me detectable activity RCS sufe 12 12-62 No Retectable returity Res safe (All) 6-19-63 No delectable activity RCS safe 12-463 no detectal bacturty RCS sufe 6-9-64 \$0.005 NC Throtelectalle RICS safe 12-20-64 < 0.005 pc- Mo detectable RCS safe

THE UNIVERSITY OF MICHIGAN PHOENIX MEMORIAL LABORATORY

Memo .a: Waste Snipment File

From : N. L. Millis

nealth Physicist

Date : July 17, 1969

Subject: Shipment of Radioactive Waste To Nuclear Engineering Corporation, July 14, 1969.

A shipment of fifteen (15) 55 gailon steel drums containing radicactive waste was dispatched from PML on July 14, 1969 via Associated Truck Lines. Its destination was the Nuclear Engineering Corporation waste burial ground in Moorehead, Kentucky. The following is a description of that shipment:

Barrels No. 1 trhough No. 11

Laboratory waste packaged by RCS on Main Campus and transferred to PML for pickup by Associated Truck Lines.

Barre, No. 12

Sealed sources as follows:

Cა-60	80 mCi	RCS
Sr-9C	20 mCi	2 light sources
Co-60	250 mCi	PML
Tm-170	0.3 mC:	Marine Eng. Dept.
Tm-170	0.1 mCi	Chem. and Met. Dept.
Ra-226	25 mCi	RCS _.
Sr-90	9.4 mCi	Dr. Ramavatram (?)
Y5-169	0.1 mCi	RCS
?o−3e	0.1 mCi	(?)
Ra-22á	10 mCi	RCS

Two large gears (from Willow Run) 10 mCi Fe-55 70 millirem/hr. contact barrel ó millirem/hr. @ 1 meter Weight - 1000 lbs.

Larre. No. 13

from place from Bromine-82 propare for approximately 500 mCi Fe-55, 500 mCi Fe-57, 100 mCi Ag-110 m

Sealed cources; 2 mCi ir-192

60 millirem/hr. contact barre.
 6 millirem/hr. @ 1 meter

Weight - 1000 lbs.

NUCLEAR ENGINEERING CO., INC.

P. O. BOX 146 - BURNS BLDG. MOREHEAD, KENTUCKY

COWELL CAUFORNIA

P. O. BOX 356 BEATTY, NEVADA

1. Transport Index

P. O. BOX 594, WALNUT CREEK, CALIFORNIA

RADIOACTIVE SHIPMENT RECORD FORM 2. Transport Group 3. Type: Quantity/4. Label Required

FROM: _	UNIVERSITY	OF HICHIGAN.	RADIATION	CONTROL SERV	ICE DAT	E July 9.	1969	.196

1121 Catherine Street, Ann Arbor, Michigan 48104 PAGE 1 OF_ two

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P. O. BOX 146-MOREHEAD, KENTUCKY

P. O. BOX 594 WALNUT CREEK, CALIFORNIA

P. O. BOX 356 BEATTY, NEVADA NO. 47/9

RADIOACTIVE SHIPMENT RECORD FORM

CONTINUATION SHEET

	121 Catherin	e Street	Ann Arbo	or, Michigan	48104	PAGE	two of tw	10	
ITEM NO.	PHYSICAL STATE	RADIATIC AT 2"	AT I METER	PRINC PAL ISOTOPE(S)	MILLICURIES BY-PRODUCT	2.come.com	3. sounce 4	CUBIC FEET	FIN.
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332 massi	England !	192 3H	3-20-48	S	48	909	3-22-18	68
23 Nouroscience	Margaro P.	32p 3H,146	3-21-78	S	39	204	3-22-48	82
424 mod Sci	morin	125 J. 3H	3-21-48	S	33	205	3-22-78	68
John Gram Incin	latn. Com	85 46 141 81		3	400			69
2242 mod Sci	Midaley	125 T	3-21-78	S	31	204	3-22-48	69
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DATE: 3/28/93

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DATE: 3/28/78

Date 3-AF-14

RADIOACTIVE SHIPMENT JEBURD

BESAULTE HALL RECEPTION AS SERVICE OF SERVICE AS SERVICE THE MARTINET BEAUTIFF FOR PROPERTY OF A TOMIC DISPOSAL CO., INC.

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Maron Hall

Sr 90

20 me 1956? Sr 90 subfate (Blackwell)

985

Thick walled glass-metal backing Vision Research.

3-28-57 % detectable activity Room 21A

3-28-57 No detectable activity Room 21A 1-11-58 No detectable activity Room 21A 9-15-58 No detectable activity Room 3433

Sent to Ohio State in case of Prof. Blackwell

Wet smear - G. M. & scales Mason Hall Sr90 20 20 mc 1956? Sr 90 sulpkate

(Blackwell)

Wissin Research 986 12-4-63 The detectable activity Als safe 6-9-64 For Setulable activity Sovosac RCS safe Room 21A 3-28-57 No detectable activity Room 21A 12-20-64 < 0.005 pc - 70 detectable RCS safe 1- 5- 58 No detectable activity Room 21A 4-28-58 No detectable activity 6-16-65 < 0.005 µc - No detectable RCS safe R.C.S. safe Trytten Willow Run 12.29-65 <0.005 pc - To detectable RCS safe 11-21-58 % detectable activity 6-8-66 <0.005 pc - No detectable RCS safe 5-22-59 No detectable activity Willow Run 11-17-59 No detectable activity 12-14-66 20.005 me R.C.S. Sofe Contact Joe Mudar, Infra Rfdlat. Bldg. 41 6-8-67 20.005 mc RC.S Jagre Bldg. 41 3-21-60 No detectable activity 12-18-67 20.005 per: No Detectable 10.C.S. Sale. 9-22-60 No detectable activity Blog. 41 Res Safe Res Safe 6-12-68 L.005 per 6-20-61 Source proper appears to be cracking. 12-19-68 120,005 CCi Has been removed from location till May - 1969 6-21-61 No detectable activity R.C.S. safe 12-12-61 No Satestable activity, R.C.S. safe. 6-22-62 No detectable activity RCS safe 12 W. Ot the activity RCS safe

FOR INTRI-UNIVERSITY COMA, SPONDENCE

THE UNIVERSITY OF MICHIGAN PHOENIX MEMORIAL LABORATORY

Mamo .o: Waste Shipment File

From : N. L. Millis

nealth Physicist

Date : July 17, 1969

Subject: Shipment of Radioactive Waste To Nuclear Engineering Corporation, July 14, 1969.

A shipment of fifteen (15) 55 gallon sreel drums containing radicactive waste was disparented from PML on July 14, 1969 via Ausociated Truck Lines. Its destination was the Nuclear Engineering Corporation waste buria, ground in Moorehead, Kentucky. The following is a description of that shipment:

Barrels No. 1 trhough No. 11

Laboratory waste packaged by RCS on Main Campus and transferred to PML for pickup by Associated Truck Lines.

Barra. No. 12

Sealed sources as follows:

20 mCi	2 light sources
250 mCi	PML
0.3 m.Ci	Marine Eng. Dept.
0.1 mCi	Chem. and Met. Depr.
25 mCi	RCS
9.4 mCi	Dr. Ramavatram (?)
J.1 mCi	RCS
0.1 mCi	(3)
10 mCi	RCS
	250 mC! 0.3 mC! 0.1 mC! 25 mCi 9.4 mCi 0.1 mCi

Two large gears (from Willow Run) 10 mCi Fe-55 70 millirem/hr. contact barrel 6 millirem/hr. @ 1 meter Weight - 1000 lbs.

Carre. No. 13

from pipes from Bromine-82 propert flow approximately 500 mCi Fe-55, 500 mCi Fe-57, 100 mCi Rg-110 m

Sealed sources; 2 mCi Ir-192

• 60 millirem/hr. contact barrol 6 millirem/hr. @ 1 meter Weight = 1000 lbs.

NUCLEAR ENGINEERING CO., INC.

COWELL CALIFORNIA

P. O. BOX 594, WALNUT CREEK, CALIFORNIA

P. O. BOX 356 BEATTY, NEVADA

P. O. BOX 146 - BURNS BLDG. MOREHEAD, KENTUCKY

1. Transport Index

2. Transport Group

RADIOACTIVE SHIPMENT RECORD FORM

3. Type: Quantity/4. Label Required

FROM: UNIVERSITY OF MICHIGAN, RADIATION CONTROL SERVICE DATE July 9, 1969

1121 Catherine Street, Ann Arbor, Michigan 48104 PAGE 1 OF ____two PAGES

METE THIS FORMATIN TRIPLICATE BINT BACK THE

- the requirement lated below. Suference is made to IOCFR.20,
 - L TANTON BERNELLING MARINATE POR 20.203,

(Per. 20,401, (d.)

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ITEM NO.	PHYSICAL STATE	RADIATIC	H, MR/HR	PRINCIPAL ISOTOPEIS)	MILLICURIES BY-PRODUCT	2.00mms (01mm)	S remot	CUBIC FEET.	FINAL
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#5	Solid	5.0	1.0	C. SN. 7-15	5.0.30.41	MI	A RY.B	7.3	
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<u>* 7</u>	Solid	5.0	1.5	2, 19C, 1624	5.3.5	MI	AFYE	73	<u></u>
				16 37	0/001,01	H II, II	4		
*8	Solid	0.0	0,	11 19C	20, 20	II, II	AFY	7.3	-
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ORIGINAL

P. O. BOX 594 WALNUT CREEK, CALIFORNIA P. O. BOX 356 BEATTY, NEVADA NO. 47/9

RADIOACTIVE SHIPMENT RECORD FORM

CONTINUATION SHEET

FROM U	NIVERSITY O	F HICHIGA	N, RADIAT	ON CONTROL	SERVICE	DATE	July 9, 196)	_196
1	121 Catheri	ne Street	. Ann Arbo	or, Michigan	48104	PAGE1	two of two	<u> </u>	
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fer of new technology to the active water and waste water professionals in the mid-west area, he established a conference centered on the newest innovations in the field. This conference was first offered in 1950 and has been co-sponsored by the Civil and Environmental Engineering Department and the Michigan Department of Public Health ever since. It is conducted every two or three years. It is now named the Borchardt Conference and is held on the University of Michigan Campus. The 20th conference will be held in 2005.

The undergraduate option in Construction Engineering was **ad**opted in 1948.

In 1949 the Structural Engineering Laboratory had a 400,000 pound capacity universal testing machine, a loading frame for testing large assemblies, deformeter gages loading frames for testing models, electric strain gage equipment, and a well equipped shop for making models and test assemblies. These facilities allowed the testing of full-scale structural members and small scale models. The laboratory provided for class demonstrations, graduate study and research.

In 1949 the Michigan Chapter of Chi Epsilon was established with Professor Jack A. Borchardt as advisor.

In 1952 the Transportation Institute was established with Professor John C. Kohl as Director. The college announcement in 1953-54 lists the faculty and staff as of 1952 as follows: Earnest Boyce, Professor of Municipal and Sanitary Engineering, Chairman of Civil Engineering Department and Professor of Public Health Engineering in the School of Public Health; Robert H. Sherlock, Professor of Civil Engineering (Structures); Harry Bouchard, Professor of Geodesy and Surveying and Director of Camp Davis; Walter C. Sadler, Professor of Civil Engineering; Lawrence C. Maugh, Professor of Civil Engineering (Structures); William S. Housel, Professor of Civil Engineering (Soil Mechanics); Bruce G. Johnston, Professor of Structural Engineering; Ernest F. Brater, Professor of Hydraulic Engineering; Walter J. Emmons, Professor of Highway Engineering and Assistant Dean and Secretary of the College of Engineering; Glenn L. Alt, Associate Professor of Civil Engineering (Construction); Edward Young, Associate Professor of Geodesy and Surveying; John C. Kohl, Associate Professor of Civil Engineering (Transportation) and Director of the Transportation Institute; Leo M. Legatski, Associate Professor of Civil Engineering (Structures); Arnold J. McFarlan, Assistant Professor of Geodesy and Surveying; George M. Bleekman, Assistant Professor of Geodesy and Surveying; Jack A. Borchardt, Assistant Professor of Civil Engineering (Sanitary Engineering); Robert B. Harris, Assistant Professor of Civil Engineering (Construction); Frank E. Legg, Assistant Professor of Engineering Materials; Donald N. Cortright, Assistant Professor of Civil Engineering (Highway Engineering); Robert O. Goetz, Instructor in Civil Engineering (Soil Mechanics); Eugene A. Glysson, Instructor in Civil Engineering (Sanitary Engineering); Vladas D. Merkys, Resident Lecturer in Civil Engineering (Hydraulics); Wadi S. Rumman, Instructor in Civil Engineering (Structures).

In addition to the above were technicians George Geisendorfer in charge of the structures, hydraulics and sanitary laboratories, and Lorenzo Plumpton who was responsible for the geodetic and surveying equipment.

An indication of the number of Civil Engineering degrees granted over the years up to 1952 follows:

Bachelors Degrees in Civil Engineering

1857-79 1880-99 1900-19 1920-39 1940-52 Total 177 232 922 1,163 710 3,195

Graduate Degrees in Civil Engineering (believed to be low)

1857-79 1880-99 1900-19 1920-39 1940-52 Total 4 19 49 330 354 756

Source: "A Century of Engineering Education," U of M Press 1954, pg 1177.

In 1951-52 the College Announcement indicated there were 238 undergraduates in Civil Engineering.

In 1953 Professor Harry Bouchard died and Professor Bleekman assumed the Directorship of Camp Davis. Mr. Glenn O. Lease was appointed Instructor of Civil Engineering (Structures) and Professor E. Wendell Hanson was appointed Professor of Meteorology.

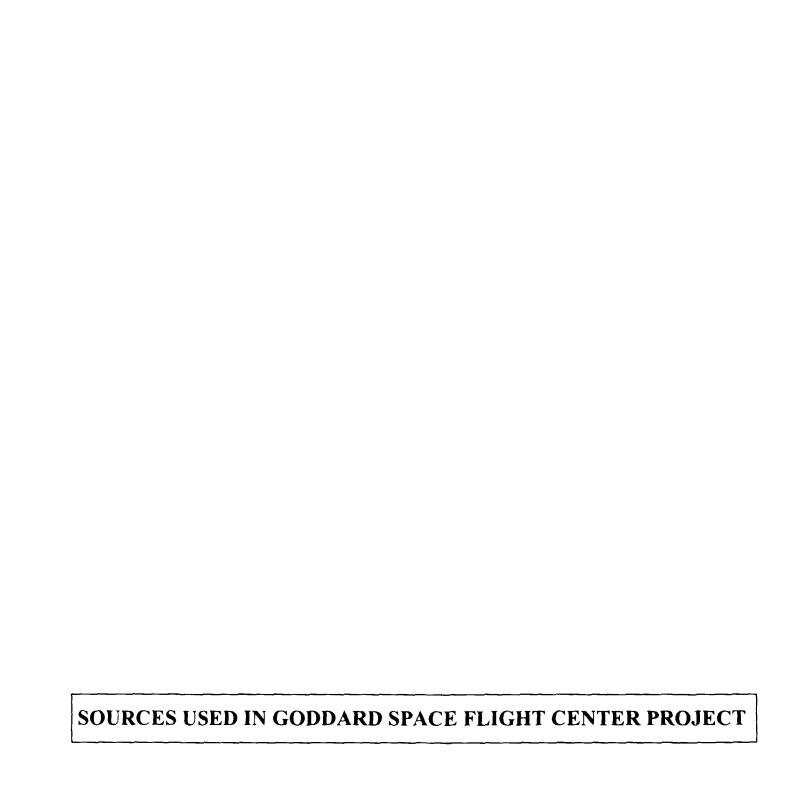
The program in Meteorology had been assigned to the Department of Civil Engineering to provide a location to present its course work and conduct its research until it could become established. Several other faculty members would be added in the next few years, namely, A. Nelson Dingle, Lecturer in Meteorology in 1954 and Gerald C. Gill, Lecturer in Civil Engineering (Meteorology) in 1956.

In 1958 the Meteorology area included Frank R. Bellaire, George W. Reynolds, Donald J. Portman, David L. Jones, and Floyd C. Elder. All were Lecturers in Meteorology at that time. The Meteorology group was transferred to the Engineering Mechanics Department in February 1961.

In 1953 Clinton L. Heimbach was appointed Assistant Professor of Railroad Engineering. In 1954 Ward K. Parr was made Associate Professor of Highway Engineering, and Ralph M. Berry, Professor of Geodesy and Surveying. The graduate program in Construction Engineering was established in 1954 by Professor Robert Harris.

In 1955 Victor L. Streeter was appointed Professor of Hydraulics, and in 1956 Glen V. Berg was appointed Lecturer in Civil Engineering (Structures). Berg would become Chairman of the Department in 1969.

The development on North Campus to eventually allow the movement of the College of Engineering to this location had proceeded in 1957 to the completion of the Automotive Laboratory which was to provide space for the Civil Engineering surveying classes and instrument room. The Mortimer Cooley Laboratory had been completed in 1955 along with the Phoenix Memorial Laboratory. This construction was followed by the completion of the Fluids Engineering Building in 1958 which provided laboratory facilities and space for all engineering departments with fluid dynamics interests. This provided the hydraulics laboratory for the Civil Engineering Department. The Fluids Laboratory would be later renamed the G. G. Brown Building.



THE UNIVERSITY OF MICHIGAN

SPACE PHYSICS RESEARCH LABORATORY DEPARTMENT OF ELECTRICAL ENGINEERING



SPACE RESEARCH BUILDING ANN ARBOR, MICHIGAN 48105 313-764-9460

March 13, 1968

Mr. N. L. Millis Health Physicist Phoenix Memorial Laboratory North Campus

Dear Mr. Millis:

Enclosed are copies of our quick scan records for our AM-241 sources. Currently we have 5 sources, Nos. 10F, 1I, and 3 also 1g and 2g which we received March 6, 1968.

Sources 10F and 1I are mounted on our vacuum system, source 3 is stored in Room 1340B. Sources 1g and 2g are on schedule to be shipped to Ft. Churchill, Canada about April 5, 1968.

Sources 13A, la and lf were shipped March 2, 1968 and are to be launched from Puerto Rico March 15, 1968. As was mentioned in our recent telephone conversation, we no longer have any tritium sources.

Also should our absolute filter from our hood exhaust be checked or replaced?

Sincerely,

P. O. Handy

Associate Research Engineer

POH: jb

Enclosures

1-0	2-0	3-P	4-P	5-P	6-P	TF	8F	9F	10 F	11 P
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	Ruived 12-9-66	Ruined 12-9-66	Received 12-9-66	Rained 12-9-66	Ricewick 1	2-12-21	Received 4-10-17	13-15 67	12 words	A-10-67	Received Andrews
•	2.5 mc. A 8350 F 1.62µ0.e	A 8350 F	2.5 mc. A 8350 F 1.62 \mu 0.C.	2.5 mc A8350 F 1.62 µ 0.C	2.5 mc 125550 F. 1.62 ju c.C.	2.5 mc P. 8354 F 1.63,44.2	2 5 mc A 6350T 1,624 0.6	2.5 mc A E355 T 1.42 D C 2	2.5 mc A E350 F 1.62,40.0	2.5 mg. R 6350 F 1.424 C 6	2,5 m A 3 m 5 1,62 m 5 c
	Doble Sir. #5 8-20					Denote Son. #2 D-27	Carth Ser. # 3 17-28	Dentle Sen. # 4 C-25	Double Ser. # 5 C - 25	For the See	0.0d. #7 D-27
						204	203		·	197	20.2
			X		\times	X	\times	\times	\times	\times	\times

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25	3	10	29	
 1200 mg	Reduct 4-12-67	B-2-48	3-2 65	
2.5 mm 2.5350 m 1.42 m63	2.5 m A 834: F 1634: 1	2.5 mm P. 8.3524 2.1,4.33	2.5 min position 2.1,263	
المؤن ع	#9.	Dias Sc	Brack Sec.	
D-28	Pic 1			
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	*	*		·
SPRL Source	1-C	2-0	3-P	1-P
USRC Source No.	# /	# 2		* /
Approx. Date Rec.	1-13-65	1-13-65	8-25-65 5 mc. with	2-9-66 5mc. with
Nominal Activity	.66 mc	1.1 mc.	1.62 M Au Seal	4.07 µ Au. Seal
Physical Construction	Foil Pieces Sost Soldered IN Stamless Cup	Foil Pieces 50ft Soldered IN Stainless Cup	Foil Soft Soldered to feed thru Pins on Stainless Headen.	Foil Soft Soldered to feedthru Pins on Stainless Header
USR C Leak	•	Solox Swab on Source 1-6-65	Solox Swab on Source 7-23-65	No INformation Sent by USRC
Test Results	250 C/MIN.	300 c/MIN	900 c/min.	·
SPRL Leak	IN VICINITY of Source	Source	In vicinity of Source	IN VICINITY of Source
Check Results	2 6 C/MIN.	< 6 C/MIN.	< 10 C/MIN.	2 6 c/rins
Environmental Testing	Vacuum Cycled Vibration Tested		Vacuum Cycled	Vacuum Cycled
Leak Check Record	10-1-66 = 10 C/MIN	10-1-66 = 10 C/M	10-1-66 < 6 C/MW	26 C/MIN
			,	
	-			
Location & History	Flown on X-15 Oct -66	Stored IN Rm 1024 SPRL 12-1-66	Disposed of by RC5 10-13-66	Disposed of by RCS 10-13-66
-	Stored IN RM 1024 SPRL 12-1-66	Phoenic Ld		
!		7 = 1340 8 8-11-67		
	French Jac	Launch Feb 68		
	Lauren Feb 65 Arcas 11	Ancas I		

takut O. Handy Sheet #1.

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SPRL Surce	5-P			7 -
No.	9-7	6-P	7 F	8F
USRC Source	# 2		. # /	# 2
No.			F 2/ //	
Approx. Date Rec.	2-9-66 10 mc with	6-16-66 5mc. with	5-26-66 5 mc with	5-26-66 5 mc. with
& Nominal Activity	8.03 µ Au Seal	1,62 M Au Seal	1.62 µ Ad Seal.	1.62 M Aa Seal
Nominal Accivity	Foil Soft Soldered	Foil Soft Soldered	Foil Soft Soldered	Foil Soft Soldered
Physical	to feed thru Pins	to feedthru Pins	to feed thru PINS	to feed thru PINS
Construction	ON Stainless Headen			ON Stainless Header
	No INFORMATION	Solox Swab on	Solox Swab on	Solox Swab on
USRC Leak	Sent by USRC	Source 6-9-66	Source 5-23-66	Source 5-23-66
Test Results		750 C/MIN.	4700 c/nw.	1500 c/MN.
		IN VICINITY of	In Vicinity of Source	IN VICINITY OF SOURCE
SPRL Leak	None Taken.	Source		< 6 C/HIN.
Check Results		15 c/min.	10 c/min.	
Environmental	No Testing	Vacuum Cycled.	Vacuum Cycled Vibration Tested	Vacuum Cycled Vibration tested
Testing	Performed.		VIORATION TESTED	7/8/2/100 /20/
Tools Charle		10-19-66	8-14-66	7-10-66
Leak Check Record	None	20 c/MIN.	2 6 C/MIN.	26 c/nin
•			-	
<u>.</u>				·
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		,		
	Sout back to	Sent back to	Installed in	Installed IN
Location & History		USRC 10-26-66	Nose CONE B-16-18	Wose CONE 8-15
niscory			0-16	7-12-66
			Launched From Wallops Isl.	Launched from
			, , , , , , , , , , , , , , , , , , , ,	Ft. Churchill
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Patrick O. Hamy

SPRL Ource	9 <i>F</i>	54: <u>X</u> 10 F) 11 P	12 P
USRC Source	# 3	# 4	#/	* 2
Approx. Date Rec. & Nominal Activity	5-26-66 5mc. with 1.62 M Au Seal	5-26-66 Вте, with 1.62 µ Au. Seal	11-1-66 2.5 mc, with 1.62 µ Au. Seal.	11-1-66 2,5 mc. with 1.62 µ Au Seal.
Physical Construction	Foil Soft Soldered to feedthru Pins on Stailess Header	Foil Soft Soldered to Feedthru Pins	Foil Soft Soldered to feedthru Pins on Stainless Heapen	Foil Soft Soldered to feed thru Pins
USRC Leak Test Results	Solox Swab on Source 5-23-66 2300 c/mm.	Solox Swab on Source 5-23-66 1500 e/mw.	Solox Sweb on Source 10-28-66	Solox Swab ON Source 10-28-66 350 C/MIN.
SPRL Leak Check Results	IN VICINITY OF Source LG E/MIN.	In Vicinity of Source	IN VICINITY OF Source	Invicinity of source
Environmental Testing	Vacuum Cycled Vibration Tested	Vacuum Cycled Vibration Tested.	Vacuum Cycled	
Leak Check Record	8-7-66 < 6 c/min.	8-14-66 26 C/MIN	11-26-66 < 6 C/MIN	6-20-67- 50 c/min
	•		6-20-67 70 c/nin	
Location & History	Installed W Nose Cone B-17 B-B-66 Launched from Wallops Isl.	12-1-66	Stored in Rm. 1024 SPRL 12-1-66 Phoenix T 15 11p 27 Shiffed to USC!	Stond IN Rm 1024 SPRL 12-1-66 Phoenic The Marine 4 124
		T. F. 1.11 67	Nov. 67 (5, m) ped)	the second se

Space Physics Research Laboratory

Fatrick O. Handy Sheet #3

SPRL Surce	* 540 <u>711</u> 1 I	21	31	4A
USRC Source No.	# /	* 2	* 3	* 4
Approx. Date Rec. & Nominal Activity	12 - 2 - 66 2.5 mc. with 1.62 m An Scal	12-2-66 2.5 mc. with 1.62 M Au Seal	12-2-66 2.5 mc With 1.62 M Az Seal	12-2-66 2.5 mc. with 1.62 M Au Seal
Physical Construction	Foil Soft Soldered to feedthru Pins on Stainless Header	Foil Soft Soldered to feedthnu Pins on Stainless Header	Foil Soft Soldered to feedthru Pins on Stawless Headen	Foil Soft Soldered to feedthru Pins on Stainless Header
USRC Leak Test Results	Solax FilterPaper ON Source 11-29-46 50 Elmin	Sclox Filter Paper ON Source 11-29-66 2 20 C/MIN.	Solox Filter Paper an Source 11-29-66 <20 C/min.	Solox Filter Paper on Source 11-29-66 < 20
SPRL Leak Check Results	In Vicinity of Source 24 C/MIN	IN VICINITY of Source 14 a/MIN	IN VICINITY OF SOURCE	IN VICINITY of Source
Environmental Testing	Vacuum Cycled Vibration Tested.	Vibration Tested		Vacuum Cycled Temp. Cycled Vibration Tested
Leak Check Record	12-13-66 4 4 C/MIN	1-9-67 24 C/min	12-24-66 24 C/MW.	12-21-66 < 4 c/min.
·		rii.		
			Installed in	Talul
Location & History	Stord IN RM. 1024 SPRL 1-30-67	Installed IN Nose Cone C-23 1-9-67	Nose CONC C-22 12-24-66	Installed 11 Nosc Cone 8-19 12-21-66
	54 3 466 Phose Til 141. 67	Launched from Ft. Churchill. Can. 2-1-67	Launched from Ft. Churchill, Can. 2-1-67	Launched from Ft. Churchill 2-1-67
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Patrick O. Harry

	1			
SPRL Source	5 A	6 A	7.5	8 <i>I</i>
•				
USRC Source No.	*5	* 6	*/	# 2
Approx. Date Rec.	12-2-66 2.5 mc. with	12-2-66 2.5 mc. WIth	12 - 13-66 .2.5 mc. with	12-13-66 2.5 mc. with
Nominal Activity	1.62 M Au Seal	1.62 µ Au. Seal.	1.62 M Au Seal.	1.62 M Au Scal.
Physical	Foil Soft Soldered to feed thru Pins	Foil Soft Soldered to feedthru Pins	Foil Soft Soldered to feedthou Pins	Fail Soft Soldered to feedthru Pins
Construction	ON Stainless Header		ON Stainless Header Solox Swab on	ON Stainless Header
USRC Leak	Solox Filter Paper ON Source 11-29-66	Solox Filter Paper ON Source 11-29-66	Source 12-9-66	Solox Swab ON Source 12-9-66
Test Results	150 C/MIN.	100 C/MIN.	100 C/MIN.	50 c/min.
SPRL Leak	In Vicinity of Source	In Vicinity of Source	IN VICINITY of Source	IN VICINITY of Source
Check Results	LA E/MIN	< 4 4/min.	< 4 c/min	< 4 C/MIN.
Environmental Testing	Vacuum Cycled Temp. Cycled Vibration Tested	Vacuum Cycled Vibration Tested.	Vacuum Cycled Vibration Tested	Vacuum Cycled Vibration Tested.
Leak Check Record	1-4-67 24 C/MIN	12-21-66 <4 C/MIN.	12-31-66 2 4 C/MIN	1-4-67 <4 C/nin.
· · · · · · · · · · · · · · · · · · ·				
Location & History	Installed IN Nose Conc C-21 1-4-67	Installed IN Nose Cone B-19 12-21-66	Installed INT Nose Come B-20 12-31-66	Installed IN Nose Conc C-21 1-4-67
,	Launched from Ft. Churchill 2-1-67	Ft. Churchill 2-1-67	Launched from Ft. Churchill Z-1-67	Launched from Ft. Churchill 2-1-67
	1		1	<u>'</u>

Space Physics Research Laboratory Americium-241 Radioactive Sources

Partick O. Hardy Sheet #5

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i	SPRL Source		•		
	No.	91	10 I	11 A	12 A
	USRC Source	# 3	* 4	# 5	# 6
	No.	3	7	3	
		12-13-66			12-13-66
	Approx. Date Rec.	2.5 mc with	12-13-66	12 - 13 -66	
	&		2.5 mc with	2.5 mc. with	2.5 mc. with
-	Nominal Activity	1.62 M Au. Seal			
1		Foil Soft Soldered	Full Soft Soldered	Foil Soft Soldered	Foil Soft Soldered
	Physical Physical	to feed thru Pins	to feedthru Pins	to feedthro Pins	to feedthru Pins
	Construction	on Stanless Headen	on Stanker Header	ON Stanless Header	on Stainless Header
!		Solox Snab ON	Solox Swab on	Solox Sunb ON	Solox Swab ON
		Source 12-9-66	Source 12-9-66	Source 12-9-66	
	USRC Leak	5		Source 12-1-66	Source 12-9-66
	Test Results	< 20 C/MIN.	50 C/nin.	150 C/HIN.	< 20 C/MIN
		IN VICINITY of	IN VICINITY OF	IN VICINITY OF	IN VICINITY of
	_	Source	Source	Source	Source
	SPRL Leak	_	·		_
	Check Results	<4 C/MIN	< 4 C/MIN	<4 C/MIN.	< 4 c/nin.
		Vacuum Cycled	Vacuum Cycled	Vacuum Cycled	Vacuum Cycled
	Environ mental	Vibration Tested	Temp. Cycled	Temp. Cycled	Temp. Cycled
	Testing	VIBRATION lested	Vibration Tested		Vibration Tested
		1-11-67	1-9-67	12-31-66	1-11-67
	Leak Check	i -			< 4 C/min
	Record	24 C/MIN	< 4 C/MIN	< 4 C/nin	Z 7 YMIN
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			- / // /		
	Location &	Installed in	Installed in	Installed in	Installed IN
		Nose Cone C-24	Nose Come C-23	Nose Cone B-20	Nose Cone C-29
	History	1-11-67	1-9-67	12-31-66	1-11-67
	•	,	<u>-</u>	_	
		Launched From	Launched from	Launched from	Launched from
		Ft. Churchill	Ft. Churchill	Ft. Churchill	Ft. Churchill
		2-1-67	2-1-67	2-1-67	2-1-67
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Americium-241 Radioactive Sources

Patrick O. Handy Shut #6

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SPRL Source	13 A	14 A	1 a	16
USRC Source No.	# 7	*8	*/	**2
Approx. Date Rec.	12-13-66 2.5 mc With 1.62 µ Au Seal Foil Soft Soldend	Foil Soft Soldend	A-10-67 2.5 mc with 1.62 m An Scal. Foil Soft Soldered	4-10-67 2.5 mc with 1.62 MAR Seal. Foil soft Soldered
Physical Construction	to feed thru Pins on Stainless Header	to feed thru Pins on Stainless Header	to Feedthru Pins in stankers Header	to Feed than PINS ON STAINKES HEADERS
USRC Leak Test Results	Solox Smab ON Source 12-9-66 < 20 C/HIM	Solox Swab on Source 12-9-66 20 Grin	5Wab ON Source 4-10-67 150 C/HIN	5 Nab on Source 4-10-67 400 C/MIN
SPRL Leak Check Results	INVICINITY OF SOUTH	IN Vicinity of Source < 4 Chin	IN VICINITY 05 SOUTH	IN VICINITY of Source
Envir onmental Testi ng	Vacuum Cycled Vibration Tested	Vacuum Cycled Temp. Cycled Vibration Tested	Vibration tested.	Vacour Cycled Vibration tested
Leak Check Record	1-24-67 24 C/AIN	12-24-66 24 C/MIN	6-22-67 2 2 4/nin	6-28-67
· .				
Location & History	Stond IN Rn 1024 SPRL 1-30-67	Installed in Nose Come C-22 12-24-66	X-15 Plane at Calif. 7-7-67	Launched 8-4-67 Nose Come D-27
	Spar Try 17 Pin Launched Sten	Launched from Ft. Churchill 2-1-67	Launch From Puento Rico 3-15-68	Pt Earrew Alaska
	Puerto Rico 3-15-68 NC B-16		NC D-29	 - -

Americium-241 Radioactive Sources

Patrick O. Handy

SPRL Qurce	1 c	13) 1e	15
No.	16	10	1 =	1,
USRC Source No.	* 3	#4	# 5	#6.
Approx. Date Rec. & Nominal Activity	4-10-67 2.5 mc. with 1.62 M Nu Scal	1=10-67 2.5 mc with 1.62 x Hu Scal	4-10-67 2.5 mc. with 1.62 m An Scal	4-10-67 2.5 min with 122 in An Seel
Physical Construction	Foil Soft Scidered to Feedthru Pins on Stanless Header		Foil Soit Soldered To Feether Pins ON Stainless Hender	Foil Self Soldered to Freedthro Pins on Stainless Header
USRC Leak Test Results	Swab on Source 4-10-67 1100 C/MIN.	Jwab on Sooree 4-10-67 100 C/Min	Swab on Source 4-10-67 200 C/MIN.	500 6 ON SOUPER 4-10-67 350 C/MIN
SPRL Leak Check Results	IN VICINITY of Source 6 C/MIN	IN VICINITY OF Source	IN vicinity of Source	IN vicinity of Source
Environmental Testing	Vac. Cycled. Vibration tested.	Vac. Cycled Temp. Cycled V.b. Tested.	Vac Cycled Vibration Tested.	Vac Cycled Temp Cycled V.b. Tested
Leak Check Record	6-28-67. 14 C/MIN	7-19-67	7-19-67	7-24-67 2 C/MIN
	٠.			
Location & History	Launched 8-3-67 Nose Come D-28 Pt Barrow, Ala.		Rn 1024 Nose Cene C-25 8-11-67	RM 1029 Nose Core C-26 B-11-67 Launched Snom
	PT DANIEW, MA.	Laurend Fore, Willeys Isl Supt. CT	apt 67	Puento Rica 3-15-68 NC C-26

			9	₩
SPRL Jurce	2a	26	3	19
US RC Source No.	# 7	· # 8	# 9	= 1
Approx. Date Rec. & Nominal Activity	4-10-67 2.5 mc with 1.62 HAN Sent	4-10-67. 2.5 me. with 1.62 H An Seal	1-10-67 2.5 ma with 1.62 p. Fu	3-5-68 2,5 mc with 2.12 M Ax O.C.
Physical Construction	Foil Sest Solding to Fredthou Pins ON S.S. Heads	Foil Sost Soldens to Feedthra Pins on S.S. Headen	Foil Soft Solders to Feedthinu Pins on S.S. Header	on 5.5. Header
USRC Leak Test Results	5006 ON Source 4-10-67 400 C/MIN.	4-10-67	5wab on Source 4-10-67 200 C/MN.	Filter Paper 3-6-68 300 C/rin
SPRL Leak Check Results	In Vicinity of Source	Journey of Sources	IN vicinity of Source < 2 a/rin	In vicinity of Source 2 4 c/rin.
Environmental Testing	Vacuum Cyc. Vibration tested	Vac. Cycled. Vibration tested		·
Leak Check Record	6-22-67 3 C/min	6-28-67 3 c/min	7-24-67 5 C/MIN.	3-11-68 + c/run
			•	
Location & History	Laure hed 8-4-67 Nose Come D-27 Pt. Barrow, Ala.	Launched. 8-3-67 Nose Come D-28 Pt Barrow, Ala.	Rm 1024 Nose. Come C-26 E-11-67 Stoud 3-11-68 RM 13408	
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Americium-241 Radioactive Sources
Space Physics Research Laboratory

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		RADIO	ACTIVE SOURCE	QUESTIONNAIRE		
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UNITED STATES RADIUM CORPORATION

BLOOMSBURG DIVISION

4150 OLD BERWICK ROAD BLOOMSBURG, PENNSYLVANIA 17815

Telephone Bloomsburg, Pa. 784-3510 Area Code 717 TWX: Bloomsburg 717-784-2447

Data Sheet	Date: 6-6-68
Customer Maiversity of Michigan	PO# R-89843 SO# NL066847
G/O R. Handy	No. Pcs5
1121 Catherine St.	
Ann Arber, Michigan 48105	Activity Content SMC Cach
USRC or Oust. Dwg. #_B-005-222	Chemical Form American 241
Dimensions:	
Grade:	Backing: 0.010" OFHC [] 0.002" St. Steel [] Other []
CONTAMINATION SURVEY	·
Type of measurement made:	Filter Paper
Method of Leak Testing: Filter Paper ()	Swab ()
Alpha Beta Gamma	
Solvent used:	H2O () MEK () Solox ()
Instrument used:	
Internal PCC10A, 1620A CRM	
External G-M Tube 1620A CRM	GM tube window thickness 1.4 mg/cm ²
FIRST LEAK TEST	FINAL LEAK TEST 6-6-68
RADIATION SURVEY	
Type of measurement made:	
Alpha (); Beta (); Gamma ();	Neutron ()
Measurement from center of chamber:	(in.); (Meter)
Instrument used:	Beckman MX4 () Neutron ()
End Fire	POC Internal () POC External ()
Radial Fire	2586 Nuclear Chicago ()
	Other
LIGHT MEASUREMENT	
Type of measurement made:	
Brightness ()	Decay () Calibration ()
Instrument used:	USRC Photometer ()
,	Other

Swab # USRC #	swab o/m złaczejna zdzieniała	ion current amps. ul mr/hr	Microcurie removable contam- ination	Swab # USRC #	swab c/m Brem. c/m @in.	ion current amps. si mr/hr	source strength Eff. Microcurie removable contam- ination	
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We hereby certify that the parts and/or material furnished on your above captioned order have been leak tested as required under our Atomic Energy Commission License governing sealed sources and that the
results of this test showed the parts and/or material to be sealed and permissable for transfer.

Atomic Energy Commission regulations permit a
maximum removable contamination level of 0.005
microcuries. The results of our measurements on
the (swab) (filter paper) from your source(s) indicate
that the removable contamination level (is) (is not)
within the allowable limits.

	E Trank Bude ED STATES RADIUM CORPORATION
gent	F. Buck
.,	Mgr. Radioactive Prods.
Date .	6-6-68

We hereby certify that the parts and/or material furnished on your above captioned order have been leak tested.

SEPLEN NOTICE LEAD TESTING FOR ALPIN EMITTING REPRODUCT INTERIAL

कि केन्द्रेजूर पहिला जिल्लाहरू	Am-241	HOMENAT	5 mc. 13 of 6/9/66		6/9/66	CHEHICAL FORM	Americium-241		
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UNITED STATES RADIUM CORPORATION

BLOOMSBURG DIVISION

4150 OLD BERWICK ROAD BLOOMSBURG, PENNSYLVANIA 17815

Telephone Bloomsburg, Pa. 784-3510 Area Code 717 TWX: Bloomsburg 717-784-2447

Data Sheet of Radiosotope Sealed Sources	Date: 5-9-66
Radiation Control Service 1121 Catherine St. C/O Mr. P.O. Handy Ann Arbor, Michigan 48105	Activity Content 5 me
USRC or Cust. Dwg. #	Chemical Form Americium 241
CONTAMINATION SURVEY	
Type of measurement desired: (check)	
Method of Leak Testing:	Swab (_x) solox Immersion ()
Solvent used:	H2O () MEK ()
Instrument used: Internal X PCC10A, 1620 CRM External G-M Tube, 1620 CRM	Nuclear Chicago () Baird Atomic () (#1620A, 1615B) (#410) GM tube window thickness 1.4 mg/cm ²
FIRST LEAK TEST_6/1/66	FINAL LEAK TEST6/8/66
Six month leak test to be performed by Cust. or ret	turned to USRC.
RADIATION SURVEY	
Type of measurement desired: (check)	
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Alpha (); Beta (); Gamma ();	
Measurement from center of chamber:	(in.); (Meter)
Instrument used:	Beckman MX4 () Neutron ()
End Fire	PCC Internal () PCC External ()
Radial Fire	2586 Nuclear Chicago ()
	Other
LIGHT MEASUREMENT	
Type of measurement desired: (check)	
Brightness ()	Decay ()
Instrument used:	USRC Photometer ()
	Other

USRC #	swab c/m	ul mr/br	Eff. Microcurie removable contam- ination	USRC #	swab c/m	ul mr/hr	Eff. Microcurie removable contam- ination	
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"We hereby certify that the parts and/or material furnished on your above captioned order have been leak tested as required under our Atomic Energy Commission License governing sealed sources and that the results of this test showed the parts and/or material to be sealed and permissable for transfer."

Signed:
UNITED STATES RADIUM CORPORATION
Agent F. Buck
Title Mgr. Radioactive Freds.
Date _6_9_66

MISCELLANEOUS SOURCES



VETERANS ADMINISTRATION

CENTER

WILSHIRE AND SAWTELLE BOULEVARDS LOS ÂNGELES, CALIFORNIA 90073

November 8, 1971

YOUR FILE REFERENCE:

IN REPLY REFER TO:

NOV 1 5 1971

Mr. Arthur J. Solari Radiological Safety Officer The University of Michigan Radiation Control Service 1121 Catherine Street Ann Arbor, Michigan 48104

Dear Mr. Solari:

I brought the radium static eliminator with me to VA Wadsworth Hospital.

Sip**ge**rely,

WALLACE W. TOURTELLOTTE, M.D., Chief of the Neurology Service Wadsworth General Hospital

Professor and Vice-Chairman

Department of Neurology, UCLA

:dg

cc Mrs. Susan Gillis

Include Zip Code in your return address and give veteran's social security number.

Show veteran's full name and VA file number on all correspondence. If VA number is unknown, show service number.

Radiations

data sheet 20.50

radium and radioisotopeactivated foil

Radioactive foil fabrication processes have been intensively developed by our laboratories, luring the past decade, for the production of radium wellvated static eliminating units. These foils, incorporating radioactive elements or their salts as an integral part of the foil structure, provide a highly versatile means of applying radioactive emission in accord with widely varying requirements. Radioisotopes which have been used as active agents in the foil include, in addition to radium: the strontium 90 - yttrium 90 system with its high energy beta emission, thallium 204 emitting low energy beta rays, cobalt 60 offering high energy gamma emission, and polonium 210 and radium D as a source of alpha particles. Other isotopes may offer specific characteristics which would make their availability in this form interesting for purticular applications.

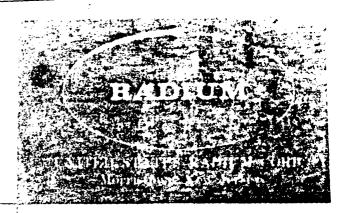
fabrication

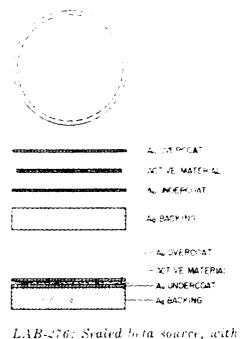
The standard type foil consists essentially of cold and silver layers welded and rolled into a thin ribbon. The radioactive agent is incorporated into the active layer of the ribbon by means of powder metallurgical techniques, and is not the plated or evaporated radioactive deposit which is frequently encountered in various sources of radioactive emission.

Standard radium-containing foil is supplied in any concentration up to approximately 1250 micrograms per square inch. In isotope-containing foils, radioactive material can be supplied in concentrations from a fraction of a microcurie per square inch up to hundreds of millicuries per square inch, within limits governed by the type of emitted radiation and the specific activity of the radioactive agent being used. An extremely high degree of uniformity of distribution of radioactive material throughout the active area is observed at all concentrations.

selective emission

Filtration of radiation in varying degrees as required in specific applications can be effected by overlaying of pre-determined thicknesses of metal as the foil surface interdependent fabrication. For efficient transmission of alpha or low energy beta particles, filtration thicknesses of a fraction of a milligram per square centimes or are available. On the other hand, reduction of particle range or climanation of undesirable radiation components can be

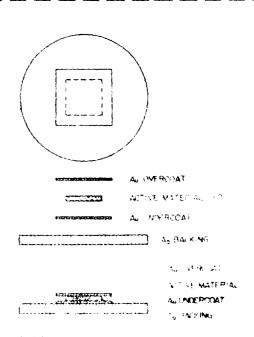




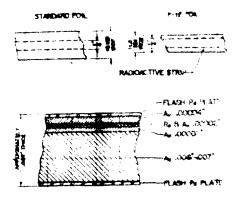
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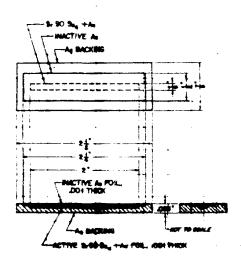
specification.



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LAB-204: Typical radium-activated foil for static eliminating unit.



LAB-365; Seeled beta source utilizing Sr^{so} fail. Surfaces joined by pressure welding.

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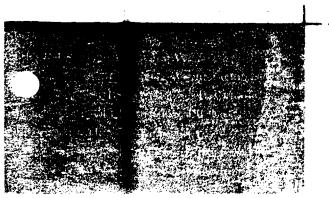
Its neartive to, we be supplied in overale thickness to used aperiorations in the range from a lower limit of a few microns to an upper limit of several thousand he of an inen. Since the foll is ready paintly disceased and formed, and can be welded or romerod, great latitude is permitted in design and type of backing which might be desirable. Poiss are available in active area to meet associfications continuous ribbons being currently supplied up to a maximum width of four inches and a maximum length of 72 inches. Inactive border areas are supplied if desired, and high resistance to oxidation and corrosion is achieved through finish plating of the foil with palladium or rhodium.

applications

The current widespread industrial utilization of radium and radioisotope-activated foils is based upon the functional effects of certain basic phenomena associated with radioactive emission: The ability of alpha and beta particles to ionize gases, the specific absorption of beta and gamma radiation within materials, and the ability of alpha and beta to produce luminescence in phosphorescent and fluorescent compounds.

These phenomena have consequently led to the use of radium, radium D and polonium activated foils in various industrial static eliminators, and to the employment of radioactive foil sections as discharge-stabilizing elements in electron tubes. Thallium 204 and strontium 90 by sed foils are used extensively as radiation sources in many types of beta and gamma gauges which determine materials density, thickness, and the variations in liquid, slurry and interface levels within sealed containers. Finally, the burgeoning market for self-luminous light sources used in photometry, emergency marking and area delineation has signalled the use of alpha and beta-emitting foils incorporating such radioisotopes as radium, radium D, and tritium.

It has been our experience that the versatility of these foils permits their adaptation, at reasonable cost, to an extensive range of industrial research, development, and production activities. Our radioactives section invites your further inquiries, and offers consultation, without obligation, an tentative applications. Prices of our standard radioisotope-activated foils are available upon require.



UNITED STATES - TELL RADIUM CORPORATION

Morrisoner, L. a.

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SAFETY LIGHT CORPORATION MATERIAL SAFETY DATA SHEET

SECTION !

#4

PRODUCT NAME .

TRITIUM FOIL OR TRITIUM TARGET (Dwg. 508-3, Titanium Tritide)

SAFETY LIGHT CORPORATION	. EMERGENCY TELE 717/784-4344	EMERGENCY TELEPHONE NO. 717/784–4344					
ADDRESS (Number, Street, City, State, and 719 C	odej.		7015				
4150-A Old Berwick Rd., Blooms	burg	PA I	TRADE NAME AND SYNONYM	ıs			
Titanium Tritide	•		N/A				
Metallic Tritide			TiT ₂				
		•					
SECTION	111 -	HAZAF	RDOUS INGREDIENTS				
PAINTS, PRESERVATIVES, & SOLVENTS	×	(Unita)	ALLOYS AND METALLIC COATING	s x	TLV (Unip)		
PIGMENTS .	1.	N/A	BASEMETAL Stn.Steel or Coppe	er	unknow		
CATALYST		N/A	ALLOYS		N/A		
VEHICLE		N/A	METALLIC COATINGS Titanium		unknow		
SOLVENTS .		N/A	FILLER METAL PLUS COATING OR CORE FLUX		N/A		
ADDITIVES		N/A	OTHERS		N/A		
OTHERS		N/A					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES							
Thin film of metallic titaniu	m de	posited	on stainless steel or copper				
substrate and impregnated with radioactive gas tritium (1H3).							
*USNRC MPC in air for insoluble forms of 1H3 in unrestricted areas =							
2 X 10 ⁻⁷ microCuries/mL air							
SEC	CTIO	N III' -" I	PHYSICAL DATA				
BOILING POINT (FA	un	known	SPECIFIC GRAVITY (H30-1)		4		
VAPOR PRESSURE (mm Hp.)	un	known	PERCENT, VOLATILE BY VOLUME (%)		unknow		
VAPOR DENSITY (AIR-1)	un	known	EVAPORATION RATE		unknowi		
SOLUBILITY IN WATER	in	soluble					
APPEARANCE AND DOOR	Gr	ay meta	llic color; odorless				
SECTION IV	EID	E AND	EVELOSION HAZABO DATA				
SECTION IV - FIRE AND EXPLOSION HAZARD DATA FLASH POINT [Melhed used] [FLAMMABLE LIMITS Lat							
N/A EXTINGUISHING MEDIA			· N/A				
Dry Chemica	1: D	rv Sand	- Avoid Use of Water!				
Consult in Advance: 1) Your		•	•	zional			
USNRC Office or 3) Your Sta							
UNUSUAL FIRE AND EXPLOSION HAZARDS		_					

fire

Avoid inhalation of air in immediate vicinity of

Name(Chemi Build Date	s) Second Solution of the second seco	113. -75 P.O.	J. Carcinste ested Jon 2 G.G. Ts.	nc/shipme	ent (COC)	Isotopemc/yr	1-3 Ena 1/11
Date	mc received	Date	mc received	Date	mc received	Date	mc received
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Name(s) Kno	11, G	lenn			93 /77 Appl.#80 235 Isotope(s) 3 _H 232 _{Th}					
			ey Lab Nucl	ear Eng		Telephone3-5830,4-8262,4-6220					
Chemical Form(s) Tritium Targets, 232 The targets/pellets											
Expires 1) NOV 30 1981 2) 6/30/86 3) mCi/shipmt 6000 mCi/yr 6000											
Date	Isotope	mC i	P.O.#	Date	Isotope		P.O.#	Date	Isotope	mC i	P.O.#
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